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POPULAR MECHANICS

An Illustrated Weekly Review of the Mechanical Press of the World

"Tells you how to do things" Written so you can understand it

Vol. 4. No. 4. CHICAGO, JULY 25, 1903. PRICE 5 CENTS.

GIANT AUTOMOBILE OF THE WOODS

Tractor Hauling 75 Tons of Logs in the Siskiyou Mountains--New Era in Haulage Marked by the Advent of These Powerful Engines--See Page 55

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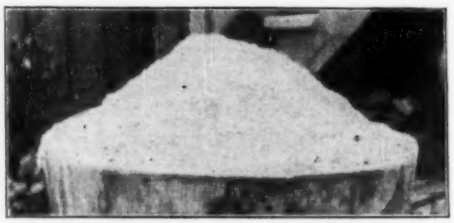

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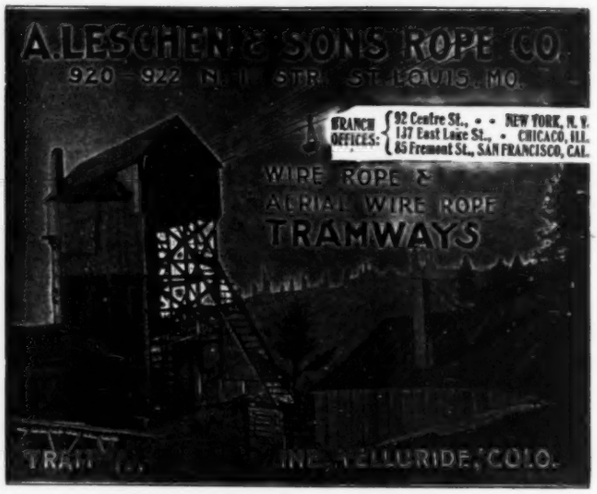
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A HISTORY OF CHAINS.

Such a simple device as a chain has an interesting history according to J. H. Wickstead, of the English Institute of Mechanical Engineers.

We did not find, said the author, sculptured evidence of a chain likely to have been made of iron until 884 B. C., though there was strong evidence that iron was well known to the Egyptians 3733 B. C. The Romans used iron freely 200 B. C., and improved the shape of the links upon those of the Assyrian sculpture, but it was only after Henry Cort invented the rolling of iron, 1784 A. D., that links of round section were made. In 1812 chain cables for ships began to be used, and the necessity of improving them led to the perfect form of chain in use to-day, the links of which, having elliptical ends, and being in length only four and a half times the diameter of the metal, give perfect freedom of movement in combination with a aximum of strength and durability. A steel chain with a weld is not as good as an iron chain with a weld.

TRANSPORT CLEARED OF 950,000 RATS.

Such a Stream of Rodents as Was Never Seen in the Orient Poured From it.

When the United States military transport Sherman arrived at Manila recently she was, as is the case with most other ships that arrive from or touch at Hong-Kong on the way to Manila, detained for inspection to see if she had any rats on board. When the big transport dropped anchor in Manila bay, therefore, the official rat inspector went on board to see what was doing in the way of rodents. In less than fiifteen minutes he hurriedly left the ship, and, going ashore, reported that there was on board the Sherman, according to the patent rat enumerator in use at Manila, no fewer than 950,000 rats.

The Sherman was immediately ordered to the quarantine station at Mariveles, as no ship on which the disease-carrying rodents are found is allowed to dock at Manila until they are exterminated. Accordingly the Sherman steamed back to Mariveles. When she arrived there her hatches had been opened up and enough sulphur carried below to kill millions of rats. As soon as the anchor was dropped the sulphur fires were started in the hold, and in a few minutes the work of the fumes became apparent.

The Manila American says: "Out of the hatches there poured such a stream of rats as was never before seen in the Orient. First by the hundreds, and then by the thousands, they appeared at the hatches, and then leaped into the water. Every one tried to swim ashore, but the distance was far too great for any rat to swim, and soon the great black line of paddling rodents began to thin out. Some of them reached a point about 300 yards off the ship, but none got any farther. After the fumes had been working for about an hour the rats stopped appearing. An inspection of the ship was made and not a rat discovered. The Sherman then reentered Manila and discharged her cargo."

IMPORTANT ANNOUNCEMENT TO SUBSCRIBERS

Instead of a 16-page weekly, Popular Mechanics hereafter will appear as a 100-page monthly in magazine form. Three weeks will be required to produce the first magazine number and the next issue therefore will be mailed August 22.

This change is made in response to the very urgent and repeated requests of our readers who find the present form of the publication inconvenient for binding. A classified index to the volume will be printed at the end of each year, thus furnishing a ready reference to the complete year's record of the mechanical and engineering progress of the entire world. The phenominal success that has attended the history of Popular Mechanics warrants the publishers in the greatly increased expense the change involves.

With more space at our command we will be able to present in each issue several complete articles of much greater length than heretofore, while the number of short descriptions and illustrations, that have so delighted the busy American public in past issues, will be increased. The magazine will appear under a handsome cover, which is now being engraved by one of America's foremost artists. We do not hesitate to assure our readers that they will find the next issue of Popular Mechanics brighter and better and more valuable than ever before.

As a magazine the journal will retain all its interesting and instructive features with many new ones added. And its motto still will be: "Written so you can understand it."

Find Ancient Pyramids in Mexico

Most Remarkable Ruins of the Western Hemisphere Discovered by Scientists

By Dr. Nicholas Leon, Head of the Section of Anthropology and Ethnology of the Mexican National Museum

The ruins in the state of Pueblo, Mexico, regarded as the most remarkable ever discovered in the Western Hemisphere, were found by the sub-secretary of public instructions in Mexico and Col. D. Poaquin Bertram, while on a recent journey through the mountainous regions of the interior. The government of Mexico sent several very eminent archaeologists and ethnologists and Senor F. Rodriguez, subdirector of the American National Museum to make official investigations.

As head of the section of anthropology and ethnology of the National museum of Mexico, I accompanied Senor Rodriguez to the scene of the ruins. We went directly to the town of Tepeyahualca in the district of San Juan de los Llanes, state of Puebla.

In a range of small hills that extend from north to south from the high neighboring mountains, the trend of which is mostly from east to west, we found a very numerous series of pyramidal constructions, guarded by elaborate trenches and connected for purposes of communication by wide avenues, which were set off at intervals by sloping acclivities, platforms and staircases. All the pyramids were found to be quadrangular and to have been built with especial reference to the cardinal points. The heights of them were from thirty to fifty feet.

These important monuments were constructed entirely of rocks and of sand stone cut and laid in juxtaposition dry —that is to say, without the use of cement. The surface dressing of the pyramids are small stones worked into cubical forms of very ornamental appearance and laid close together.

As a rule every four of the pyramids surround a court. All of them are grouped that each and every one of them guard the entrances to the courts. But if in any case the entrances are not properly protected great walls, with bases much wider than their summits, reenforce the pyramids. These walls are really streets. They are well paved with flat stones and have platforms, staircases and sloping acclivities like the avenues. Many of the walls have been thrown down owing to the destruction work of vegetation and the hand of man.

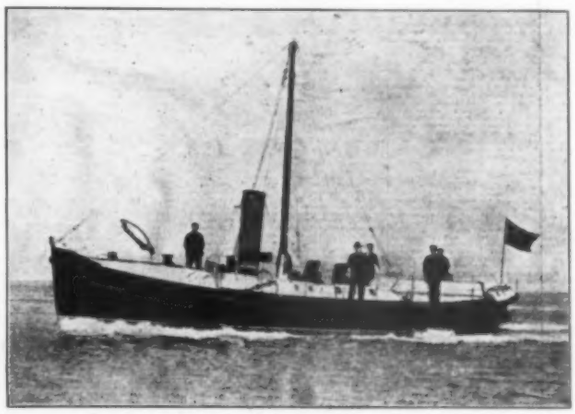
There is one avenue in particular which absorbed our attention. This started at the peak of the highest hill in the locality and sloped with moderate declivity straight down the hill. As it was evidently intended in distant times for the conveyance of loaded wagons drawn by oxen up and down the hill it was necessary to commence the construction of it at the hill top by giving to it an elevation of a few feet above the hill side and increasing the height rapidly above the hillside as it approached the vale below.

On one of the highest of the platforms and at the bases of all the pyramids we found pottery which were evidently the remains of a civilization relatively more advanced than that of the builders of the pyramids. We found also many sculptured stones in bas relief of prehistoric times. Figures of human being and animals in stone and iron were quite numerous. Domestic utensils of stone painted rose color were scattered over the ground. Stone knives and arrow heads of the obsidian epoch were encountered in great abundance.

The disposition and construction of the monuments reminds me of the ruins of Xochicalco, Monte Alban, Tinzunzan and Zacapu, in the state of Guerrero. They are the oldest, to my knowledge, in the republic and merit the most careful and extended investigation. We who have visited the ruins are determined to solve the enigma of their age and of the character of the people who built them.

STEAM LIFEBOATS FOR AUSTRALIA.

A steam life-boat has been built in England and sent to Australia. The craft is 56 feet long, 13 feet wide, and draws 3 feet 7 inches. The hull is made of steel; the engines have



Steam Life Boat

226 horse-power, and the boat will make about 15 miles an hour. It was shipped all complete ready to put in the water and use immediately on arrival. The boat weighs only 24½ tons.

WOMEN ENJOY BALLOONING.

Sport Gets a Firm Hold in Paris as Air Ships Multiply

The women of Paris are all agog over ballooning. Several of the balloons which have made the most daring flights in the past few weeks have been managed by women, and no less than six women have entered as competitors for the prize offered by the Aero Club.

Santos Dumont is overwhelmed with petitions from women who wish to go up in his new omnibus balloon, which he has not yet tried, but which is constructed to carry ewelve persons. Among his petitioners is a well-known American prima donna now in the United States, who says she will cross the ocean for the pleasure of making the balloon trip. This new airship varies little from any other models, save that it is made in four compartments, each capable of holding four persons, and the motor is of forty horse power.

HOW TO FASTEN LABELS ON BOTTLES

An annoyance from which the occasional worker often suffers is to find the labels which had been carefully attached to the bottles and put away for future use, dropping off or peeling up at the corners, says the American Amateur Photographer. This is especially apt to occur if the bottles have been kept either in a very warm, dry place or in extreme dampness, and can be prevented if, after attaching the label, it is varnished with a thin solution of sodium silicate (about 30 or 40 per cent), made up with hot water. This varnish may also be used to attach the label with, and not only serves to keep the label permanently on the bottle, but also to keep it clean and legible, as it may be wiped with a damp cloth at any time without injury.

Popular Mechanics, the journal that is written so you can understand it, will still be written that way, but will be improved.

THROUGH A MODERN PIPE FOUNDRY. PART III.

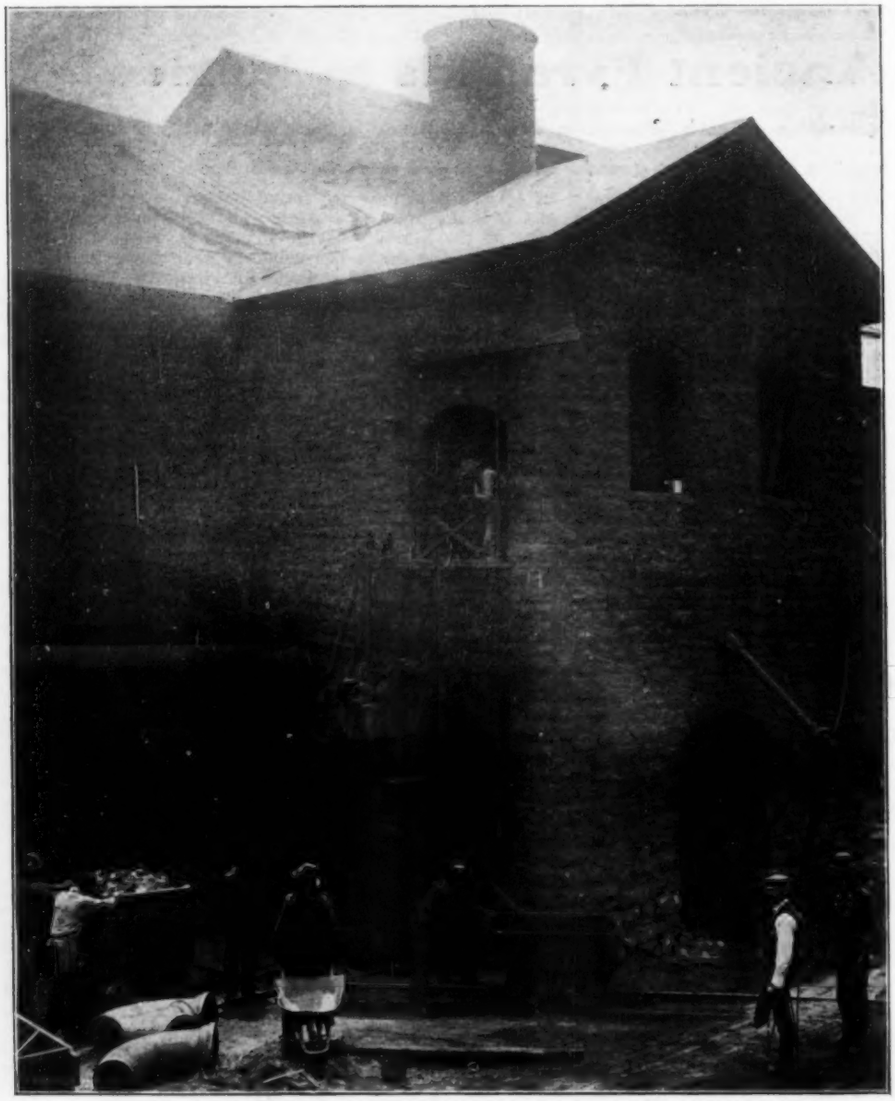
Casting—Great Care Necessary in Making Mixture and Running Cupolas.

After the processes of ramming, core making, etc., described in the preceding chapters, comes the work of casting. In the morning the dried molds are set around the casting pit, the dried cores placed in them and dry clay cake rings with "gates" in them are slipped over the cores to form the top of the pipe and center the cores at the top, and a good sized runner is formed to collect any dirt. In early days but little attention was paid to the kinds of iron used, but now great care is taken in making the mixture and running the cupolas. Many works employ chemists who take entire charge of the mixing and melting, they being held accountable for losses orginating from these sources.

The typical cupola consists of a vertical cylinder or boiler plate lined with fire brick, the dimensions being six feet inside diameter at the melting point, and about 30 feet from the bottom to roof line and about 12 feet from the bottom to the charging floor.

Every morning the sides of the cupola are repaired with ganister. The bottom doors are then closed and are fastened in place by iron props. A bottom of sand six inches deep is put on the doors and thoroughly tamped down. Wood and coke are put in and lighted. After the coke is well ignited the process of charging with limestone, iron and more coke is carried on until the cupola is filled (note the accompanying illustration). The cold air blast is then turned on, going from the blower through the wind inlet into the wind box or air chamber and from these through the tuyeres into the cupola. This air blast is supplied by a rotary blower which furnishes a pressure of from eight to sixteen ounces to the square inch, which is indicated by a mercury blast gauge. From the time when the fires are first lighted until the first iron is ready to be tapped out is ordinarily about one and one-half hours. From the time the blast is applied until the iron is ready to tap is usually about forty-five minutes.

The iron melted in the cupola is tapped into ladles, which, if in reach of the pit crane, is picked up by it and the molds are poured. If the cupolas are further away the ladles resting on trucks are pushed or pulled within reach of the crane. A story is told of a mule which was used some years ago to haul the ladles of iron in a certain foundry and which persisted, every month or two, in slipping into the pit. The foreman at last effectually cured the jack on the last occasion when he fell in, by hoisting



Cupola with Elevator

The selected scrap and iron together with coke and limestone, are raised in cars to the top of the cupola, where they are thrown in upon the wood fire. A cold air blast is then applied. The iron is melted and tapped out at the bottom into a ladle, from which it is poured into molds.

him up to the roof a number of times, and while the animal was high above the floor swinging the crane very rapidly.

After casting the core bars are withdrawn, the flasks are hoisted from the pit, chill plates and clamps knocked off, and the pipe dropped on a skid, the flasks being returned to the ramming pit. This process is called stripping.

Then the pipe is rolled through the cleaning shed where the cores are cut out with steel rods, and fins, etc., chipped off.

Pipe intended for water conduits is now heated up and immersed in a preservative liquid, usually gashouse tar, which prevents rusting. All pipe is put in a press, gaskets placed at each end to prevent leaking, and are tested (water pipe to a hydrostatic pressure of 300 pounds to the square inch), and while under pressure are struck from end to end with a hand hammer to develop any latent defects.

The weight is now painted on the side of the pipe, which is then sent to the shipping skids. While rectangular pits with revolving linings, and other types are in use, the method of manufacture is in the main as above.

Soil pipe, being made very thin, and only about four feet long instead of twelve feet, are cast on the side in green sand molds and with green sand cores.

Molding Floor

This shows the preparation of molds for "specials" or special fittings for certain pipes, such as T's, crosses, elbows and so forth. The articles on the pile of molding sand are the patterns for the "specials."

The Stock Room

This shows the material—especially selected scrap and pig iron—used for charging the cupola. The scrap is loaded into cars and conveyed to a hydraulic elevator on which it is raised to the charging floor of the cupola.

AUTOS IN THE SAHARA DESERT.

Advices have been received from Egypt to the effect that tourists in Egypt will soon be able to cross the Sahara desert in a four-miles-an-hour automobile specially constructed for traveling over sandy wastes. The vehicle is said to accommodate forty passengers, and while the speed seems absurdly slow it is greater than that of camel transportation. The Egyptians in charge of the camel transportation of course are opposing the introduction of the automobile. The English government is now using motor vehicles for transporting troops in Soudan.

WILL THE CABLES HAVE TO GO?

Mr. Ed. C. de Segundo, in Page's Magazine, contributes a critical article on the subject of "Cable and Wireless Telegraphy," from a commercial point of view. The author's remarks apply solely to the probability of existing long-distance submarine cables being superseded by any wireless system of signaling, and do not detract in any way from the splendid work which Sir Oliver Lodge, Mr. Marconi, and others have done and are doing in connection with "wireless" telegraphy, for which it is remarked there is undoubtedly a large field in directions specially suited to the conditions involved. Coming to the crux of the situation, the writer remarks that one of the chief difficulties, in fact the main difficulty, from a commercial point of view, that has to be contended with in the wireless method is to find means to enable two parties to communicate with each other without fear of their message being overheard or intercepted, and also to prevent a third party from making communication between any two parties impossible by simply working his own apparatus, and thus rendering the other parties' signals unintelligible. The consensus of opinion amongst men of undisputed scientific attainments in the field of physics and telegraphy practically amounts to this, that the failure to ensure secrecy and non-interference is in the present state of our knowledge an apparently insurmountable obstacle to the successful competition of wireless telegraphy with long distance submarine cable work.

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How to Build a Small Steam Engine

Anyone who has a slight knowledge of the use of tools can now build a steam engine. The work presents a most useful and instructive pastime, and when completed the maker has something valuable. In order to encourage our readers in the undertaking Popular Mechanics had made to order a complete set of all the castings and parts necessary to construct a 1-horsepower horizontal steam engine. The cylinder is bored and the guides milled and planed. The assembling and tool work can easily be done with the tools to be found elsewhere.

All castings and parts with full instructions will be given free for a club of new subscribers which ought to be secured in any town in a single Saturday afternoon. Write us for full particulars.

FIND RELICS OF STONE AGE.

Wonderful finds of fossils and bones of prehistoric animals are being made in the Fish Creek Country by Professor Marches S. Farr and a party of students from Princeton college. The party is composed, in addition to Professor Farr, of C. D. Thompson, Laurence Thompson, S. A. Halsey, Geordon Forbes, Walter Kimball, Charles H. Dugro, and L. S. Adsitt.

The remains of a stone-age city have been found, by which were bones of animals of great size, along with stone implements of all kinds, many of which are ornamented with gems. In a mound near the creek was found the almost complete skeleton of a man. The bones showed that the man, when alive, measured nearly nine feet in height, and was of powerful build.

Near by was the skeleton of a woman, a trifle smaller in size, and a foot, also dug up, was that from the skeleton of an animal that resembled the dog of to-day.

RURAL LIFE IN JAMAICA.

Rude Huts and Easy Life of the Natives—One Room Houses a Whole Family

Mechinical ingenuity does not figure conspicuously in the construction of the home of the rural Jamaican. A lop-sided hut of interwoven sticks with thatched roof forms the typical abode of the average family. One room is sufficient for the needs of husband and wife, sons and daughters. Fires are never needed, for the native climate furnishes more than

Home, Sweet Home, Jamaica

the desired amount of warmth. For luxuries the Jamaican does not care, but still the poorest may enjoy palm shades and flowery groves that all the gold of the American millionaire could not reproduce in his northern country home. The illustration shows a country home in Jamaica such as the tourist may see on all sides. It requires but little efforts to enable the head of the family to provide the necessities of life for himself and dependents and the remainder of his time he whiles away lounging about under the palm shades smoking his pipe.

CHEMISTS AMAZED AT POLONIUM.

Wonderful Powers It Exhibited Seemed Like a Miracle—Paper on Ozone

Just a smudge of dark powder on a piece of paper was all it seemed, but the eminent scientists assembled at the International Chemical Congress at Berlin looked at it with intense amazement. It was the first time they had ever seen the metal polonium, discovered by Professor and Mme. Curie of Paris, the metal that is worth $2,000,000 a pound. The bit of polonium was exhibited by Professor Markwald of Berlin. Mme. Curie doubted whether polonium was a primary element or related to bismuth, but Professor Markwald demonstrated that it was indeed a primary element. The metal weighed 5-100ths of a grain and was produced from two tons of uranium at a cost of $75. It is more sparsely distributed in uranium than xenon, the most rarefied gas, is in the atmosphere.

Professor Markwald proceeded to give a marvelous exhibition of the powers of this speck of polonium. It intercepted a strong current of electricity passing through the air from the generator to the receiver, the air ceasing to be a conductor for the flashes. The room was then darkened and pieces of barium, platinum and zinc blende placed near the polonium glowed with a bright, greenish light. The assemblage of chemists were thrilled with astonishment. It appeared to be a miracle.

In the section of organic preparations Professor Proskauer of Berlin read a paper on the sterilization of drinking water with ozone and ozone waterworks, the German electricians having succeeded in producing at small cost a concentrated solution of ozone. The speaker, with Professor Ohlmueller and Professor Prall of the Imperial Health Office, made exhaustive experiments with the solution in purifying water. The experiments included tests with water artificially impregnated with the deadliest disease germs, like typhus, cholera and dysentery. Such water was pumped through the so-called ozoning tower and then rigidly analyzed. All the germs were found to be killed, whereas the ordinary method of sand filters left the germs living. Moreover, the water was greatly improved in quality through the increase of oxygen from the ozone.

Professor Proskauer said the ozoning plant was cheaper than the sand filtering system usually used in city waterworks, hence the time had come for the general introduction of ozone plants. The town of Weisbaden, added the professor, already has one of these plans which sterilizes 250 cubic feet of water hourly.

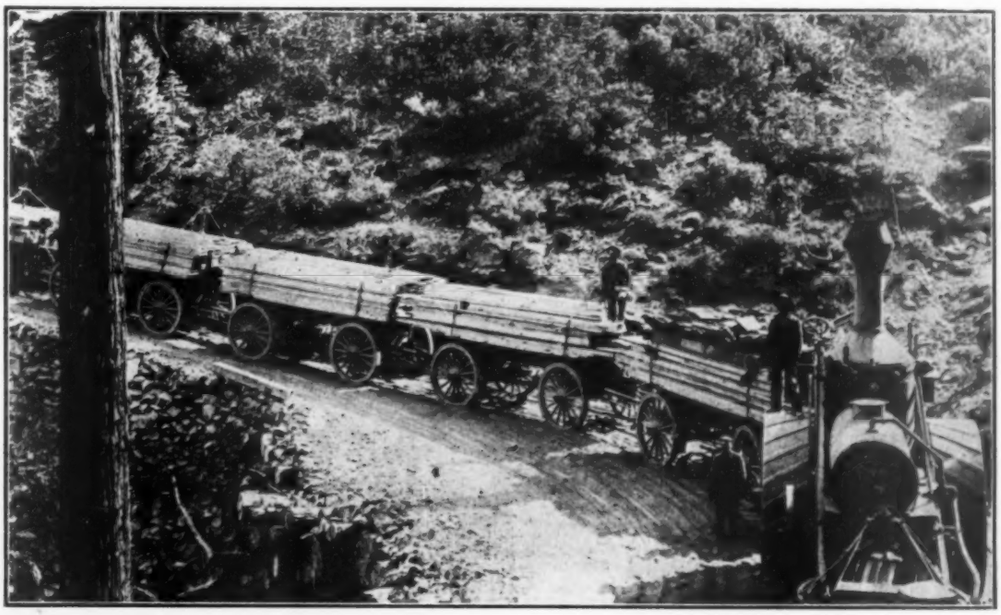
American files are monopolizing the trade of Balboa, Spain, according to the report of the British consul at that point. He says the American files are preferred because they are 70 per cent cheaper than the British files and are lighter, which is a great advantage, owing to the high customs duty levied by weight.

AUTOMOBILES OF THE WOODS.

Powerful Tractors that Make Their Own Roads as They Move Through the Forests, Marking a New Era in Haulage.

What the automobile is to the boulevards of the city, is the great modern traction engine to the rough roads of the forests. Here is where the greatest blow has been given the horse, and even the steam railroads are feeling the effects of the growing popularity of the mammoth tractors for hauling all kinds of products through wildernesses and mountainous defiles that the locomotive has never penetrated. In the mining regions of North America, South America and South Africa the traction engine is gaining such great favor as to presage a new era in haulage.

The same results can be accomplished by the traction engine in hauling logs, lumber, ore or nearly any product at much less than half the price of horse or mule power. These



Transporting 30,000 Feet of Lumber by Modern Methods

are some of the reasons that the traction engine is growing as popular in the woods as the automobile is in the city.

Enterprise says: "The general soil in the timber regions is exceedingly well apated for the utilization of the gigantic tractor with its accompanying logging train, and a special roadway is seldom required to be constructed for its passage, as the huge steel monster easily forms an excellent pathway, crushing the small timber and brush in its road betwixt the standing timber, barely sufficient space for the clearance of its bulk being essential for its operation.

Trucks of a different design from those used in ore or heavy freighting are necessary in lumbering, though the same comparative degree of strength is retained in their embodiment. In the loading of the log-trucks with the fallen timber, the truck is located beside the log and a strong chain passed securely about the prostrate timber, one end of the cable being attached to the tractor, which rolls forward, dragging the huge logs in position on the trucks, loading the train with ease and rapidity. In transporting the lumber to a general shipping station from the saw-mill the tractor is enabled to convey six or eight heavy wagons, constructed similar to the ordinary horse truck for lumber hauling, and on these wagons are loaded an aggregate of 30,000 to 40,000 feet of the sawed lumber. Grades of five to fifteen and even twenty per cent are easily traversed by this giant of traction with the loaded trucks, at an average rate of two and a half miles per hour, while on level roads a speed of three and a half miles is readily attained.

The steam power can be generated with either oil, coal or wood, without alteration to the firebox, except in the utilization of oil, an oil burner is attached.

Try a Popular Mechanics want ad.

DIAMONDS FOUND NEAR CHICAGO.

Seventeen Rare Specimens Discovered in Past Years Points to Existence of Lode

Alja R. Crook, professor of geology in Northwestern University says there are many diamonds of rare value lying unseen in the tracks of the glacial drift between Chicago and Milwaukee. They only need the keen eye of the searcher to be uncovered, he says, and 17 of them ranging as high in weight as two carats have already been found in past years.

"If a small, round, transparent, glassy or adamantine mineral of light color is found," said he, "it would be well to test its hardness. If it scratches everything available and if upon weighing it proves to be three and a half times heavier than its bulk in water it may be pronounced a diamond."

"It is possible," adds Professor Crook, "that a common mother lode of diamonds in this vicinity might be found if the lines were drawn through the finding places of the various specimens. This pocket or mine is undoubtedly somewhere between Chicago and Milwaukee."

Professor Crook talked about his claim for Chicago sands as a hiding place for precious stones with earnestness.

"The occurrene of diamonds in seven localities north of Chicago may authorize us in expecting to find them even closer at hand. All of the gems found were located either in the sand and gravel of kettle moraines or in the beds of streams."

BALLOONS AS SANITARIUMS.

How would you like to be shot up into the air a few thousand feet in a balloon or air-ship for a few hours' inhalation of pure air? Physicians say that such a poceeding is very likely to become common in the treatment of certain diseases as soon as aerial navigation is perfected. The merit of the method cannot be disputed as cases are only too numerous where patients would be greatly benefitted if they could breathe air which is free from the infections of a large city. Air-ships may also solve the problems which confront the children's fresh air societies. To secure an altitude of a mile for a sick person would be only a matter of a few minutes; to go to the mountains would take hours or several days.

The German government will employ 150 doctors to combat the mysterious "tropical worm" disease which has attacked 20,000 Westphalian miners.

Popular Mechanics is written so you can understand it.

EASY ELECTRICAL EXPERIMENTS

By L. P. Dickinson

HOW TO MAKE A LARGE INDUCTION COIL.—III.

After the various sections of the induction coil are wound, as described in the last chapter, they must be connected together or "stacked." Each section is connected in series with its neighbor, and the turns are so connected that the current will go around each section in the same direction. Between the sections are two rings cut from heavy manila paper, the outer diameter of the rings being four inches. Three rings separate the sections, and prevent a spark from passing between the sections.

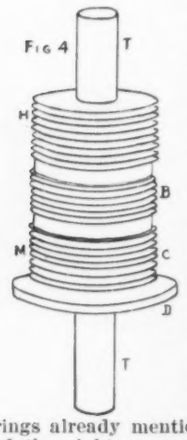


Fig. 4

Take a piece of board about ⅞ inch thick, and cut a circular piece 4¼ inches in diameter. Through the center bore a hole, which shall be large enough to admit the pasteboard tube containing the primary, and make a tight fit. This piece of wood is seen at D in Fig. 4, with the tube projecting at T for a distance of three inches.

The method of stacking the sections is indicated in Fig. 3 of the preceding chapter. Beginning with the bottom section, lay upon it one of the paper rings already mentioned. The bottom section should be one of the eighteen sections of 1,000 turns. Cut a little slit in the edge of the paper ring, in as far as the wire, and through this slit pass the terminal of the wire. Now on top of this lay another paper ring, with its slit turned around so as to be 90 degrees from the first slit. On top of this place the second section, passing its terminal through the proper slit, and connecting it to the terminal of the first section with a small, soldered joint. Proceed in a like manner with all the sections, taking care to have two paper rings between each section, and to have the joints between the wires as far from each other as possible.

The "stacking" is to be begun upon the board D, Fig. 4, as a base, the sections being piled up around the primary. Between the first section and D is to be placed a wooden ring whose outside diameter is 3⅝ inches, and whose thickness is ⅝ inch. After piling up nine of the smaller sections, insert another wooden ring whose thickness is ⅝ inch. Then put the larger sections (those containing 1,500 turns) into place. Above these place another wooden ring ⅜ inch thick, and above this the remainder of the 1,000 turn sections. The

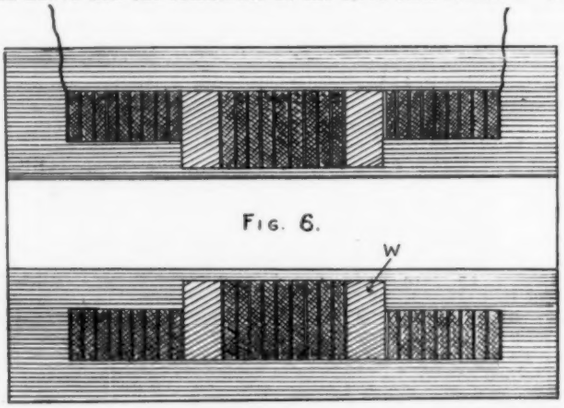


Fig. 6.

wooden rings used should be thoroughly dried in an oven and then well soaked in boiling hot paraffin wax before being used.

The two terminals of the finished secondary may be brought out at the ends, one through a small hole in D, the other being left sticking straight upward. Now select a piece of heavy wrapping paper, and of it make a stiff tube which shall surround D and the coils which it supports. This tube is to be filled with melted wax, so it must make a tight joint with D. A string wrapped tightly about it will help make the joint tight.

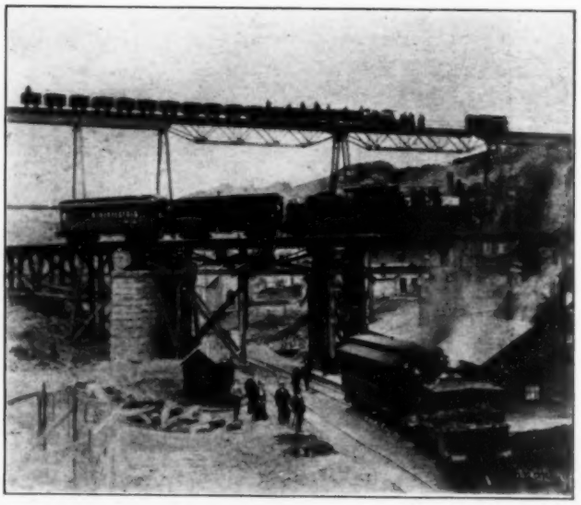
Now make up a mixture by melting together four pounds of rosin and one pound of beeswax. When this mixture is hot, pour it into the tube containing the sections. A heavy weight should be placed on the sections to keep them from floating, which may be removed when the wax is nearly solidified. The wax should extend above the top of the sections for a distance of ⅝ inch. As the wax cools it contracts, and more hot wax must be added from time to time.

A section of the finished secondary is shown in Fig. 6, the primary being removed. The outer paper tube, as well as D, is removed, as they are only temporary. Also the wooden ring nearest D is removed by chipping away the wax, and its place filled by pouring in hot wax.

One of the interior wooden rings is indicated at W.

THREE STORIES OF TRAFFIC.

In the town of Lead, South Dakota, is perhaps the most peculiar railroad crossing in the world, for no less than three different roads meet at this point, but none on the same grade. One above the other they extend, requiring two bridges above the railway which is on the surface. This remarkable state of affairs is due to competition between two systems in the West. The Chicago, Burlington & Quincy first laid its tracks through the valley which forms the only natural approach. The company thought it had shut off all rivals, but surveyors of the Chicago & Northwestern found that they could also reach it by making a cut through the hills which form the sides of the valley in which the community lies. This plan was determined upon and what is known as the Elk Horn Valley branch of the Northwestern was extended literally over the town, for the trains reach it



Busy Crossing at Leads, S. D.

on a trestle work elevated at a considerable height above most of the streets. The vicinity is noted for its extensive ore deposits and it is the center of the Homestake mines, one of the largest copper producers in the West. The mining company owns fields on each side of the valley, and to connect its properties decided to build a viaduct, as shown in the photograph, which is much higher as will be noted, than the Elk Horn Valley road. Over the viaduct are hauled trains of ore cars not only by steam, but by compressed air locomotives. As a singular coincidence, at the time the picture was taken, a train on the Burlington road, also one on the Elk Horn Valley, a train of ore cars drawn by one of the mining company's steam locomotives, and a compressed air motor were all within range of the camera, so that not only this "three-story" railroad, as it might be termed, but four different systems of transportation are shown in the picture. This overhead crossing is noted among railroad men throughout the West owing to its peculiarity.

A locomotive builder says: "We see no reason why there should be more failures with large engines than with those of medium size, except that the enormous pressure due to increased diameter of cylinders and high steam pressure have not been fully realized. This, however, is a matter that can be learned by experience."

Popular Mechanics is written so you can understand it.

BATTLESHIPS OF ANCIENT DAYS.

Not Like Those of Present Time, But they Often Wreaked Frightful Carnage

War vessels of ancient days, when people fought with spears, javelins, bows, battle-axes, etc., were of construction quite different from the powerful steel structures of today. The illustrations show the kind of war vessels used by the Northmen, the inhabitants of Norway and Denmark, in the tenth century, at the time when Rollo, the Northman outlaw, banished from his country, invaded France, and there established the famous line of Norman dukes, from which descended William the Conquerer. While these vessels were far less formidable than those of today, the carnage executed in their conflicts was usually greater than in modern marine battles. The vessels, while of wood, were built wonderfully strong, much more so than any wooden vessel of the present day. They were propelled by oars and sails and the prows were usually decorated with some peculiar beaked design emblematic of their mission of death. The ancient galley was the most common form of these war vessels. It was propelled by oars, whether or not it was equipped with masts or sails. It was often from 100 to 200 feet long, having 20 oars on one side. It had two or three masts rigged with lateen sails, and carried a complement of 1,000 or 2,000 men, and was very efficient in mediaeval warfare. Galleon, galliots, galleasses, half galleys and quarter galleys were all modifications of this type.

Marauding Expotition of the Northmen.—Drawn by H. Vogel

Rollo Besieging Paris—Drawn by A de Nedville

The lower illustration shows Rollo besieging Paris with a fleet of these boats. It was when Charles the Simple was king of France. Charles was made prisoner in the city while the siege progressed and through negotiations the land now constituting Normandy was given to Rollo and his successors as their permanent possession.

FORESTS IN THE BOTTOM OF THE SEA.

Strange and Unknown World Inhabited by Many Queer Animals

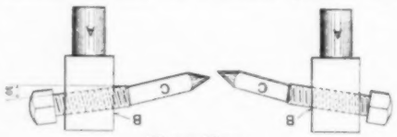
Great forests of seaweed cover the bottom of the ocean, and reach from the greatest depths to the surface. In these forests there is life more diversified than in the primeval forests of the tropics. Spiders and wormlike animals of enormous size, infusoriae, crabs, sea urchins, shells, crustaceans, starfish, turtles and millions of other things of all kinds find their home in these unfathomed deeps.

Such are the facts that have been established by the latest scientific discoveries. It has been until recently the prevalent impression that at great depths in the ocean no organic life could exist, for no light penetrates as far, and the pressure of the water there is very great. As a matter of fact, the pressure is so great that ordinary articles of wood are compressed to half their ordinary size, if lowered to a depth of 3,000 feet. A diver at the depth of 10,000 feet would have weight upon him equal to several hundreds of the largest and heaviest locomotives. There are depressions very much deeper, however, and soundings have been made establishing depths of more than 22,000 feet near the Island of St. Thomas, in the Atlantic, and of almost 27,000 feet near the Japanese in the Atlantic, and nearly 27,000 feet near the Japanese coast.

SHOP NOTES

HANDY PLANER AND SHAPER CLAMPS.

A writer in Machinery sends the sketch of a style of planer clamp which he recently found very convenient for holding some long, narrow pieces that could not be handled in a chuck or held down by straps. Some pieces of iron or steel 1½ inch square by 5 inches long were turned down at A to fit the holes in the platen of the planer. At B a hole was tapped, at an angle of 10 degrees with the horizontal, and fitted with a ⅝-inch cup-pointed setscrew. Pieces of square, self-hardening steel were cut in lengths of about 2½ inches and a point, similar to that on a center punch was



Planer Clamp

ground on one end. The other end was ground round to fit the cup point of the setscrew. These pieces are placed with their pointed ends against the work and the other ends in the cup of the screws, as shown in the sketch. In this way the work is held very nicely. If the marks caused by the points will injure the work, a piece of sheet metal can be placed between the work and the point. The marks, however, will be slight, as the clamping force required to hold the work firmly is very small.

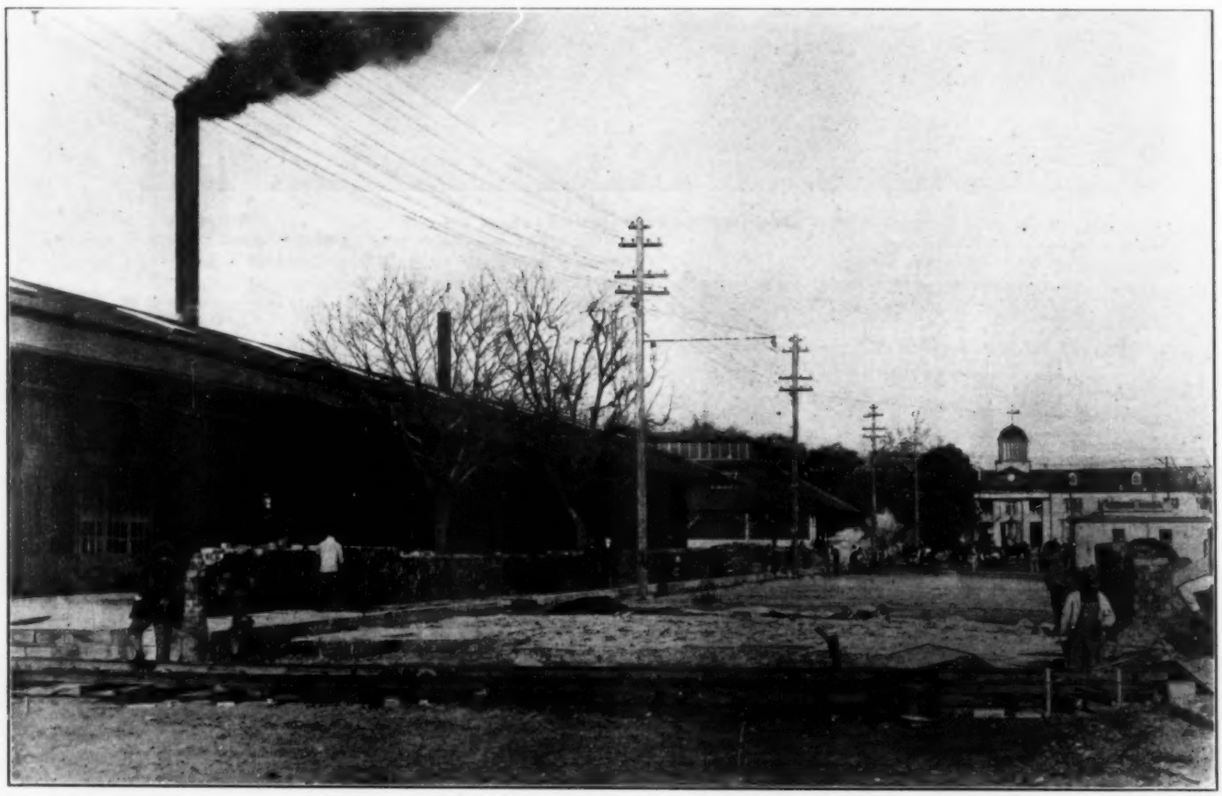
The Liberty Bell is to be exhibited at the St. Louis World's Fair and will rest in the center of the rotunda of the Pennsylvania building.

When you want anything you can get it easily by merely inserting a want ad. in Popular Mechanics.

FEW CAN TEST PORTLAND CEMENT.

Surprising Ignorance Shown—Instructions That May be of Service

The testing of cement for the concrete work in the important new improvements at the Norfolk Navy yard, resulted in the selection of Old Dominion Portland cement. In making the tests some difficulty was experienced in procuring men of proper experience in manipulating the materials so as to obtain approximately accurate results. Because of the surprising ignorance in this process Popular Mechanics herewith gives a few notes that may be of value in the future:


Norfolk Navy Yard

The test for tensile strength on a sectional area of one-quarter square inch is recommended. In the small briquettes there is less danger of air bubbles, the amount of material to be handled is smaller, and the machine for breaking may be lighter and less costly. The manner of testing the strength of Portland cement is to mold the sample into a briquette having a sectional area of one square inch and subjecting it to a pulling strain on a proper testing machine until the briquette is torn apart or broken.

For the sake of uniformity the briquette, both of neat cement and those containing sand, should be immersed in water at the end of 24 hours. All briquettes should be kept covered with damp cloth while exposed to the air. Clean, fresh water, having a temperature between 60 and 70 degrees F., should be used for the mixture and immersion of samples. The proportion of water varies with the fineness, age, and other conditions of the cement and the temperature of the air, but is approximately as follows:

For briquettes of neat cement, Portland, 18 to 28 per cent. For briquettes of one part cement and three parts sand, 8 to 11 per cent of total weight of the sand and cement. If an excess of water is used, that which does not combine chemically with the cement will remain suspended in the mass and be a source of weakness, while, if an insufficient quantity be used, a chemical action will have been set up without the possibility of its being completed, and as a result will be equally fatal to the strength of the cement.

It is not possible to give full instructions in the art of gauging a cement. It can only be acquired by practice. The cement must be brought, by dexterously working it with a trowel, to the proper consistency for filling the molds, and this condition should be attained with the minimum amount of water. The rapidity with which a cement sets or loses its plasticity furnishes no indication of its ultimate strength. It simply shows its initial hydraulic activity. For sake of uniformity all sand briquettes should be made of standard crushed quartz as recommended by the American Society of Civil Engineers. No matter whose make of machine is used for testing, the strain must be applied to the briquette at a uniform rate, otherwise a false result will be obtained, for if the weight is put on very quickly the briquette will bear a greater strain than if it is applied slowly. The stress should be applied to each briquette at a uniform rate of about 400 pounds per minute, starting each time at O. In selecting cement for experimental purposes, take the samples from the interior of the original packages at a sufficient depth to insure a fair exponent of the quality and store the same in tightly-closed receptacles, impervious to light or dampness, until required for manipulation, when each sample of cement should be thoroughly mixed, by sifting or otherwise, to insure uniformity in character throughout its mass.

The illustration shows the recent construction of a concrete bulkhead around fitting-out slip at the U. S. navy yard at Norfolk. In this work 8,000 barrels of Portland cement were used.

THE FOUNDRY CUPOLA.

In discussing the foundry cupola in the Engineering Magazine, Robert Buchanan says that whether cupolas be short or tall, the principle on which they melt is the same, the blast blowing on to the fuel, the iron to be melted being a certain distance above the points of entrance of blast. The form which the cupola shall take in the region of the tuyeres down to the bottom or hearth depends largely on the class of work for which the metal is melted. Where light castings are the main production, and thorough mixing of the metal of no great importance, tuyeres may be fixed at a short distance above the hearth. Where heavy castings are being manufactured, the tuyeres must be sufficiently high to admit of the collection of a quantity of metal before tapping. Proper mixing is not possible in a cupola with two tuyeres, from which the iron is carried away practically as quickly as melted. If it is desired to improve the quality of the iron still further by more thorough mixing, and at the same time have low tuyeres, then a receiver must be used wherein to collect the metal. But this has the drawback of increasing the consumption of coke.

Cupolas having solid bottoms are in almost universal use in Great Britain. The drop bottom is more universally used in the United States. The advantages of the solid bottom, he says, are that it requires only one making up, and retains the heat from the previous cast, and so does not chill the iron when melting is first begun. The principal drawback is the awkwardness with which the remaining coke and slag are withdrawn at the termination of the melt. The advantages and disadvantages of the drop bottom are nearly the converse of these. Our experience here differs somewhat from Mr. Buchanan's. We have found that the solid bottom requires frequent making up, and it does not retain much of the heat from the previous cast. If it did, it would not be possible for the furnacemen to go inside to repair the lining as he has frequently to do.

ANOTHER MONSTER GANTRY CRANE.

Machine to Operate in Boston Harbor Larger Than the One at Kiel, Germany

Modern mechanical progress is so rapid that closely following the publication in Popular Mechanics of an account of the big electrical crane in the harbor at Kiel comes the announcement that there is in commission in this country an even larger and more powerful lifting machine—the traveling folding jib gantry crane in the Fore River Shipyard at Quincy Point, Boston Harbor. The American hoist is not intended for loading and discharging cargo, however, but is one of the remarkable engines of a modern ship-building plant.

The Fore River gantry crane is the biggest of its kind in this country. It is built of bridge steel, is 105 feet high, with a base 56 feet by 50 feet, and the jib, which has an outreach of 94 feet, is 49 feet six inches above the track and

Gantry Crane Stepping One of the 50-Foot Stacks of the U. S. Cruiser Des Moines at the Fore River Shipyard, Quincy, Mass.

can be raised vertically so that its end is 146 feet in the air. The structure runs back and forth on the concrete fitting-out dock at which the cruiser Des Moines is now being made ready for her trials and is to be used for stepping masts and stacks, installing boilers and engines, mounting ordnance, and setting armor plate. It has two lifting trolleys that run back to the hindmost leg, one of 50 tons capacity and the other of 75 tons. At its furthest reach the machine can lift 20 tons; it will lift 25 tons 84 feet from the outer wall of the dock, and 75 tons 52 feet out. By means of it the heaviest armor plate for the great battleships building at Fore River can be fixed in place on the further side of the vessel as it lies in the fitting-out basin.

The crane looks like two big steel triangles joined at their apexes and under each of the four legs is a four-wheel truck running on narrow-gauge tracks by electric power. The fitting-out dock on which it travels consists of two heavy concrete walls, 56 feet apart, the space between being filled in solidly. It skirts the machine shop, passing a lower entrance so arranged that whole engines, for example, built on the floor above, could be lowered intact to a platform car and run out to a vessel's side, there to be picked up bodily by the gantry crane and set down inside the hull on just the spot where they must be fastened permanently. The railroad track along the middle of the dock, under the crane, is of standard gauge and connects with the spur that brings heavy material into the yard from the main line of the New Haven road two miles away.

The illustration shows the huge machine undergoing its first test when the 50-foot smoke stacks of the Des Moines, which weigh between five and six tons apiece, were stepped, each funnel being picked up from the dock and set in place at one lift.

The gross earnings of the American Locomotive Company for the year ending June 30 were $32,863,730, an increase of $6,465,335 over last year.

A homing pigeon, belonging to Lieutenant Bird of the York Point Garrison, Victoria, B. C., has made a record flight between Victoria and San Francisco, leaving San Francisco at daylight and arriving at Victoria at 8:30 p. m.

THE CARE OF A GAS ENGINE.

There are a number of little things that may happen to a gas engine, says the Mining and Scientific Press, which the attendant must look out for. An oil cup may run dry or get stopped up. A lock nut may work loose on a valve stem, and if not looked after, may wear off the cotter pin above it and allow the valve to drop into the cylinder.

An ignitor wire may work out of the terminal nut and become grounded, thereby shutting down the engine. This last would not happen if the set screw in the terminal nut had been clamped down on the wire. A trip stem nut may work loose, so as to prevent contact taking place between the points of that ignitor, thus causing the cylinder to miss fire, or it may make in the opposite direction till it allows the points to remain permanently in contact, thus short-circuiting the other ignitors and causing a shutdown.

An advantage of a two or three-cylinder engine is that a failure of one cylinder does not cause the engine to stop, and many small derangements may be cured while running. An exhaust valve may leak and need grinding. An agitator may become grounded by moisture or carbon. A battery may become exhausted and need renewal. A bearing may need keying up.

Backfiring is the ignition of the explosive mixture before it has entered the cylinder. A sharp explosion and a jet of flame from the air inlet usually accompanies it. That may be caused by a bad mixture of gas and air, burning so slowly that flame hangs in the cylinder during the whole of the expansion and exhaust stroke, thus igniting the incoming gases when the valve opens. Or more rarely, a leaky inlet valve may allow the evplosion flame to shoot into the mixture outside and ignite it. Backfiring should be cured, for it checks the speed of the engine, and sooner or later necessitates new inlet valve springs. By driving the inlet valve down till the spring comes solid it often wedges one coil sideways over another, thus crushing them together and decreasing the lifting power of the spring.

A mammoth watch, built so large that people may walk around in it among the moving wheels, is to be a feature of the St. Louis World's Fair.

MACHINERY BARGAINS

"Little Giant" ¾ yd. Traction Steam Shovel, $3,050.
Vulcan 30-ton, 1 yd. Steam Shovel, $3,350.
Marion 60-ton, Style "AA", 1¾ yd., $4,750, South.
Porter, 9x14, 36 in. gauge, saddle-tank, Dinkie, $2,400.
12 H. P. "Advance" Traction Engine, almost new, $425.
25 H. P. Erie Portable Skid Boiler, $280.
40 H. P. "Economic" Skid Boiler, $425.
14x20 Atlas Automatic Engine, $500, Chicago.
Knowles Duplex, 12x8½x12 Steam Pump, $265.
No. 71 Reading double drum Hoist, with boiler, $675.
10 other second hand Hoisting Engines in Chicago stock.
New and Second hand Machinery generally for contractors, railroads, mines and quarries.

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The Camera in War

It Serves Many Useful and Interesting Purposes--How a Kodak Loaded With Powder and Nails Effected a Prisoner's Escape

The camera and kodak as part of the accouterment of soldiers, have entered into a new field. So serviceable have they

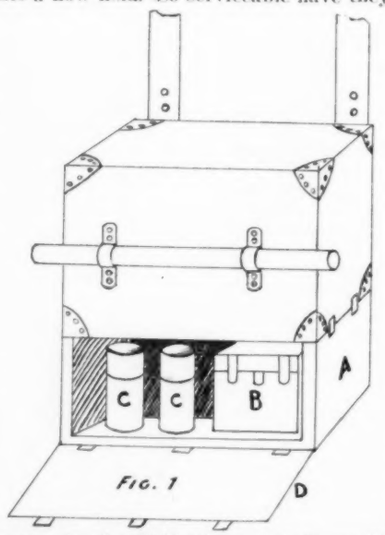

FIG. 1

proven in the Philippines that it would not be surprising to hear of their being adopted as regulation army equipment in the near future. The views obtained by the soldiers served many valuable

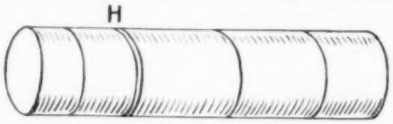

FIG.3

purposes in identifying rebellious Filipinos, criminals and localities; the camera cases were of use to soldiers in carrying ammunition and numerous small trinkets.

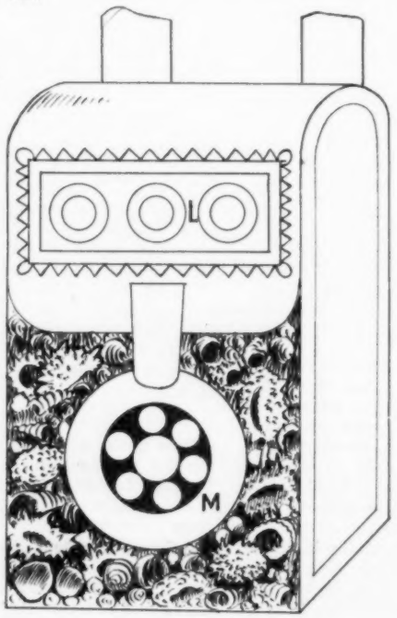

FIG.5

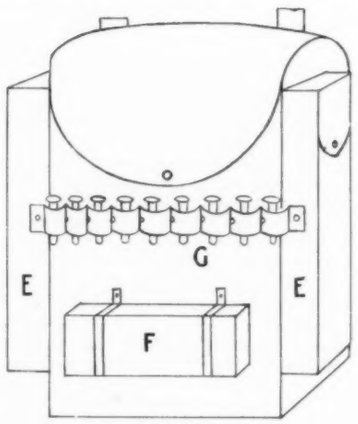

FIG.2

One soldier, by arranging a Moro pipe pistol inside of a kodak case was enabled to escape from captivity. The arrangement is shown in Fig. 4. The soldier, instead of loading his camera with films, loaded the pistol with powder and bits of nails. His captors, thinking the

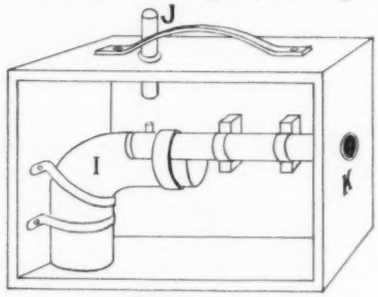

FIG.4

device was a "picture-taking machine" lined up in front of him and ordered him to take their pictures. The American pointed the camera at the line of Filipinos as if he were going to obey and dis-

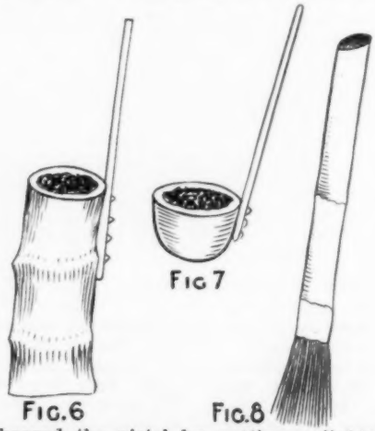
FIG 7

FIG.6

FIG.8

charged the pistol by putting a lighted cigarette through the top at J. The whole column of savages were blinded by the nail fragments and powder, and in the confusion the American soldier darted into the woods and made his escape. When pursuers came near him all he had

to do to make them turn their heels was to point the camera at them again.

Equipment for carrying kodaks and cameras as employed by some of the soldiers in the Philippines is shown in the accompanying illustrations. Fig. 1 is a square-box kodak

Crossing a River

fitted with a base apartment A into which rolls C C and box B are placed. The cover D is arranged for hooking up. A soldier with the United States engineering corps in the Philippines has to carry a revolver instead of a rifle. His ammunition he carries in a part of a belt fixed to the front of a folding-kodak case, like Fig. 2. Pockets E E are sewn to the edge of the case and are made waterproof so as to carry rolls. In the package F are carried various small articles, such as pencils, paper, stamps, strings, etc. One of the principal difficulties is keeping the films and plates dry in the drenching rains of the tropics. Waterproof tins are used by some. Fig. 3 shows a method of mailing film rolls home from the field. It is a piece of hollow bamboo tube, cut in half at H and sealed and labeled for mailing. Fig. 5 is a kodak case as decorated by one of the Dattoes of Mindanao. At L is a base of metal in which are three pearls. These are from the pearl fisheries of Jolo. At M is another cluster of pearls. The ground work is made in shells. This is more ornamental than useful for war purposes. Some of the soldiers carry their developing outfits, but usually they are compelled to keep these in the garrisons as there is no room in the haversack. Figs. 6, 7 and 8 show crude home-made devices used by a few soldiers for carrying developing liquids. The first is a piece of bamboo; Fig. 7 is a piece of cocoanut shell. Fig. 8 represents some bristles placed in a quill and used for a brush.

The half-tones show some interesting and valuable pictures obtained by soldiers in the field in the Philippines.

A contributor to the Photo Beacon, the great journal of the trade in America, says: "The difficulty of carrying kodaks and supplies in the swamps and hills of the Philippines is greater than in Cuba. I think it posssible for any one in the Philippines to carry a folding pocket-size kodak and with a little exertion and strapping the larger sizes may be carried. The film machine is most freely used in the field. One of the chief problems in the Philippine campaign is the question of supplies. It seems to matter very little how large the orders of dealers may be on the United States houses for supplies, these dealers are usually out of whatever you want. Just now I am with a column in the interior of Mindanao and could sell my 2½ by 3½ roll of films and the next two sizes larger for $2 gold each roll. In fact I would myself pay the price each for a dozen rolls. I am down to the last roll and the available views which are daily presenting themselves

Carriage Journey in the Philippines

are too good to miss. Forts and stockades are being taken and all is activity."

Work on the six-masted steel schooner, William J. Douglas, is being rushed at Fore River in order to get the vessel off the ways early next month, when the blocks for the 16,000-ton battleship Vermont will be set in her place.

MECHANICS IN MEDICINE.

No field of investigation offers more alluring inducements to the mechanical inventor than that of medicine. Many diseases, which have been most obstinate under the treatment of drugs, yield immediately to some simple device which has been invented by some one wholly unskilled in medicine. An illustration of this is the invention of a nasal disk, which purifies all the air breathed by its wearer. When one stops to consider the vital importance of pure air in cases of consumption, asthma, hay fever, etc., its value becomes apparent. Physicians have recommended that sufferers from these complaints seek a more salubrious climate as the only relief. These disks accomplish the same results in a much more efficient and at the same time convenient way.

As far as can be ascertained, the results seem to support all its inventor claims for them. The disks are the invention of W. Rollo Wilson, of the Cosmopolitan Block, Chicago, who has devoted seven years to their perfection. They consist of a small concave soft rubber band, which contains a filtering material, excluding all irritants, but permitting free respiration.

MANUFACTURE OF HOLLOW CELLULOID ARTICLES.

A German inventor applies to this end steam or hot-water pressure in molds. The hollow articles may have depressions or perforations formed in them; colored celluloid ornamentations are applied to their outer surfaces, and they are again placed in the molds and submitted to the steam or hot-water pressure, so that the added celluloid becomes embedded and a smooth exterior is obtained. They are allowed to cool under pressure.

Five battleships a year is President Roosevelt's naval policy. This means naval expansion which will make the first adequate to the needs of the nation within the next few years.

The director of the mint has purchased for Philippine coinage 63,000 ounces of silver at 53.35 cents to be delivered at San Francisco.

A train of 78 loaded cars on the Pennsylvania made the run from Altoona to Harrisburg, Pa., 132 miles, in six hours and thirty minutes.

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In the path of the blinding spray,
And he shall hark in the crushing dark
For the surf in the open bay;
And he shall hold through sleet and wind,—
Muscle and heart of steel,—
And take his trick on the seething deck,
The guardsman at the wheel.

One shall ride in the racing ropes,
Glittering, thin, and white,
And he shall cling to the reeling Thing
That's drunk o' the cup of Night;
And he shall perch on the topmost spar
In the face of the tempest fangs,—
Watching afar, like a wakeful star,
Aloft the lookout hangs.

One shall walk the narrow bridge
To the song the breakers sing,
And he shall rule his kingdom stanch
With the might of a sailor king;
He shall hold his hand to her throbbing heart
Through the passionate hour of wreck,
And the toil and tears of the hurried years,—
The man o' the quarter-deck.

These are the emperors of the waves
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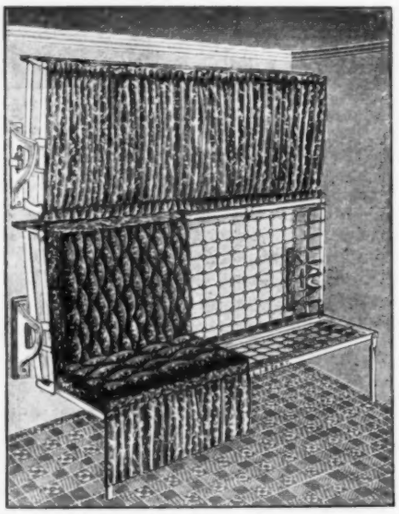

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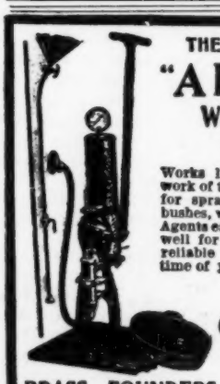

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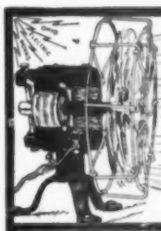
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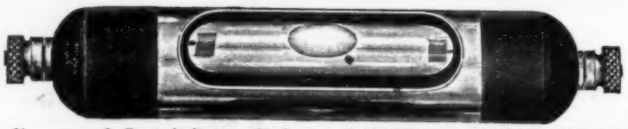

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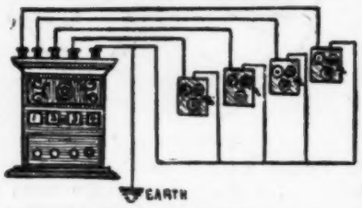

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